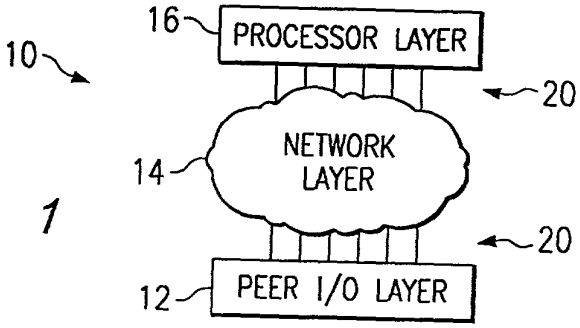

16
PROCESSOR LAYER
10
20
NETWORK LAYER
14
20
12
PEER I/O LAYER

FIG. 1

FIG. 2

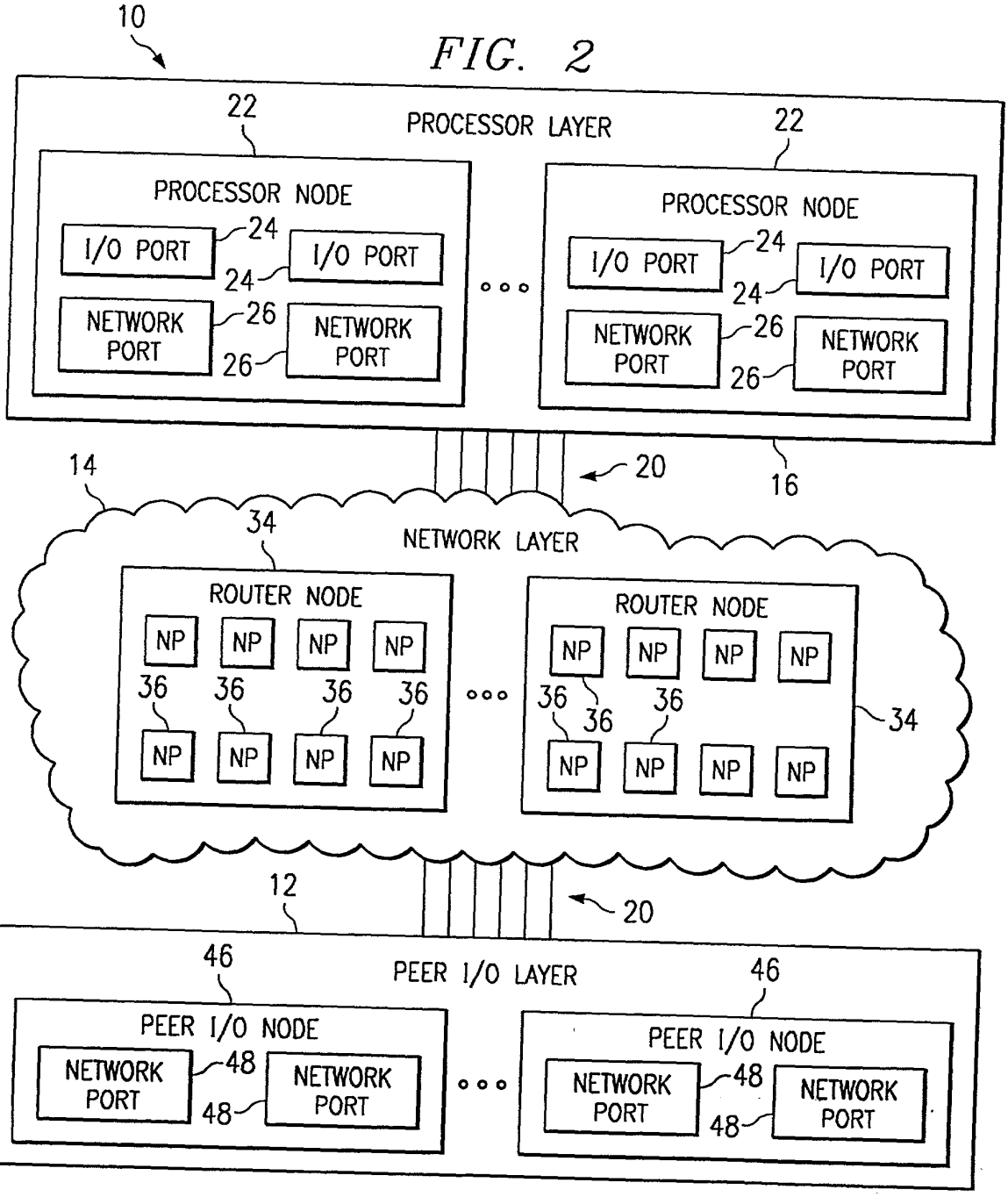

10
22
PROCESSOR LAYER
22
PROCESSOR NODE
I/O PORT
24
I/O PORT
24
NETWORK PORT
26
NETWORK PORT
26
PROCESSOR NODE
I/O PORT
24
I/O PORT
24
NETWORK PORT
26
NETWORK PORT
26
14
20
16
34
NETWORK LAYER
ROUTER NODE
NP
36
NP
ROUTER NODE
34
12
20
46
PEER I/O LAYER
46
PEER I/O NODE
NETWORK PORT
48
NETWORK PORT
48
PEER I/O NODE
NETWORK PORT
48
NETWORK PORT
48

FIG. 3

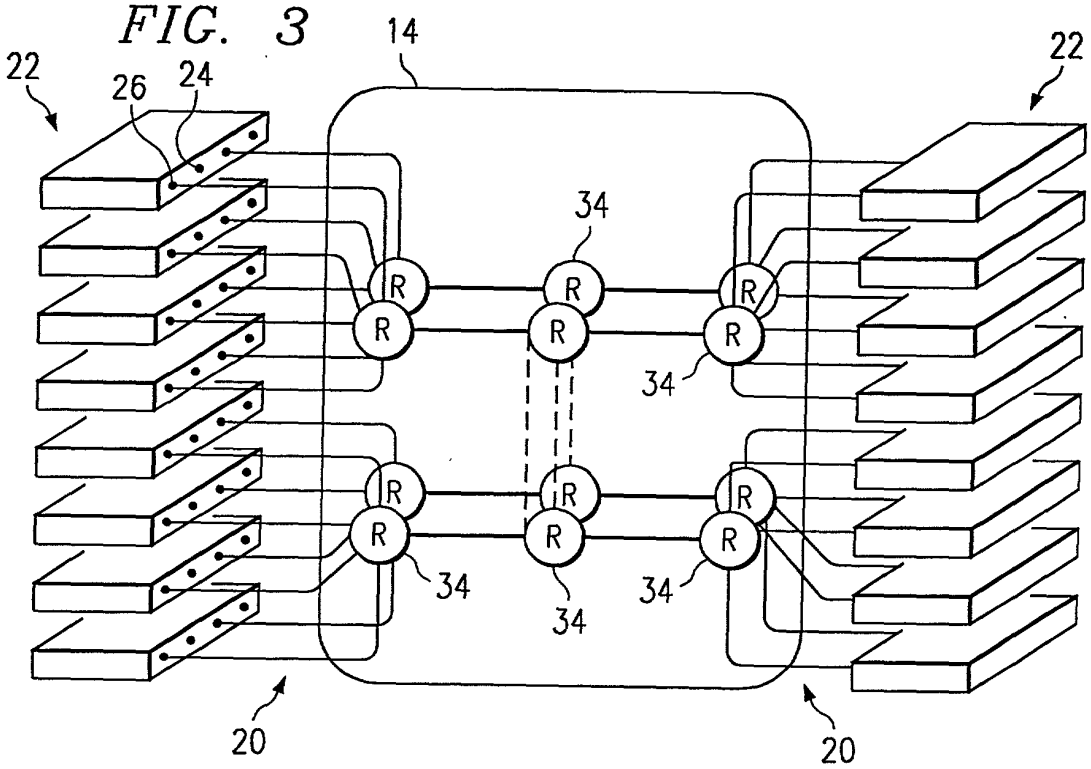
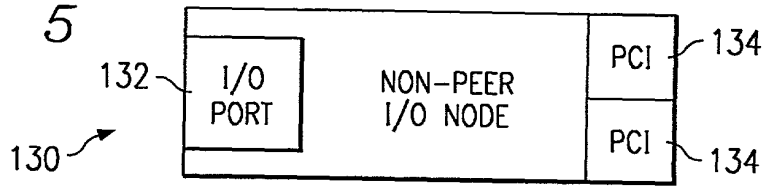


FIG. 5



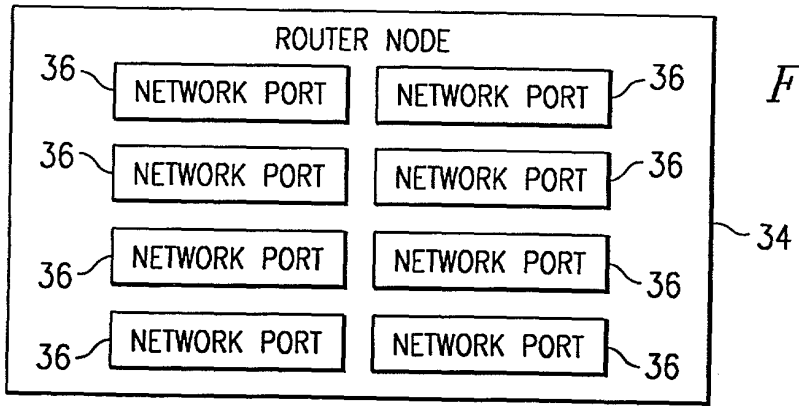


FIG. 6

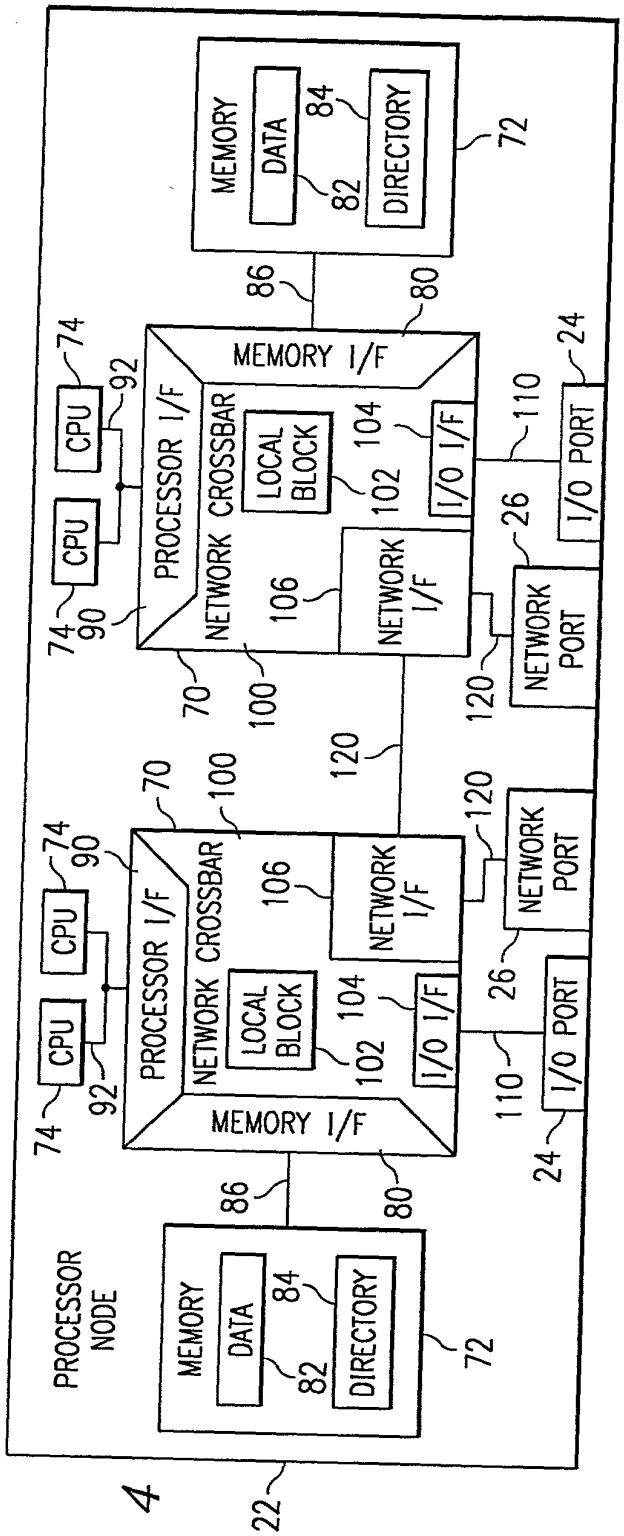

PROCESSOR NODE
22
MEMORY
DATA
82
84
DIRECTORY
72
86
80
MEMORY I/F
PROCESSOR I/F
NETWORK CROSSBAR
LOCAL BLOCK
102
104
I/O I/F
106
NETWORK I/F
100
70
CPU
74
90
92
120
NETWORK PORT
26
I/O PORT
110
24

FIG. 4

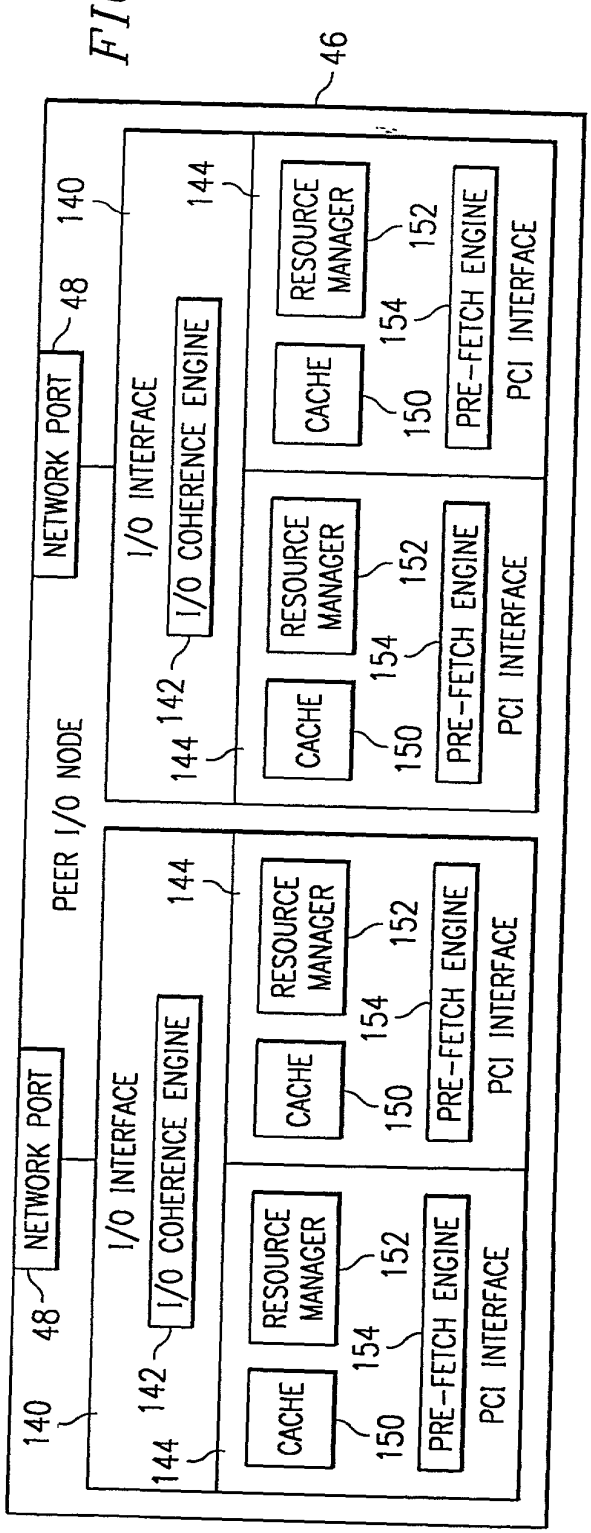
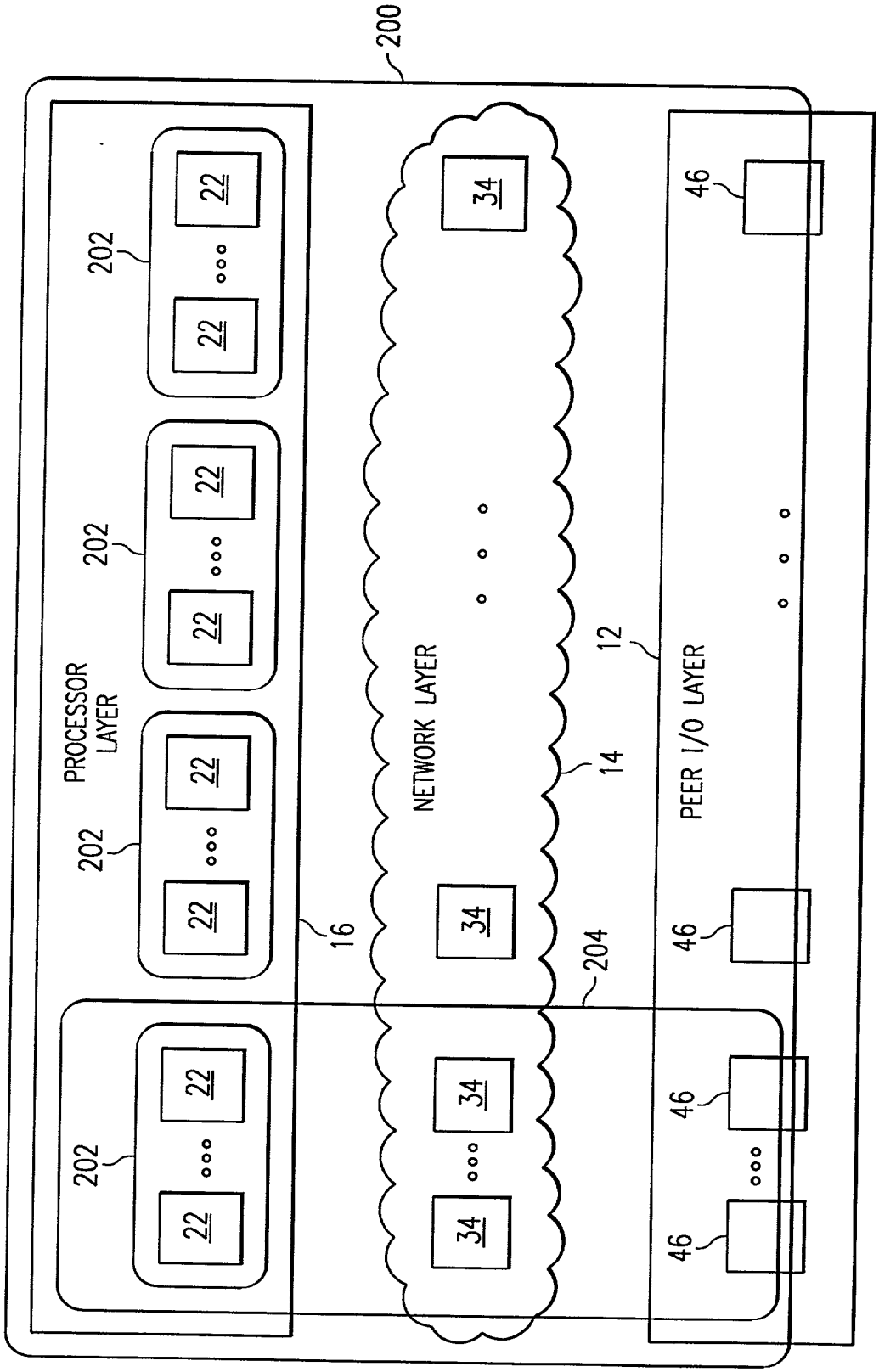

46
PEER I/O NODE
140
NETWORK PORT
48
I/O INTERFACE
I/O COHERENCE ENGINE
142
144
CACHE
150
RESOURCE MANAGER
152
PRE-FETCH ENGINE
154
PCI INTERFACE

FIG. 7

FIG. 8


200
PROCESSOR LAYER
202
22
NETWORK LAYER
34
PEER I/O LAYER
46
12
14
16
204

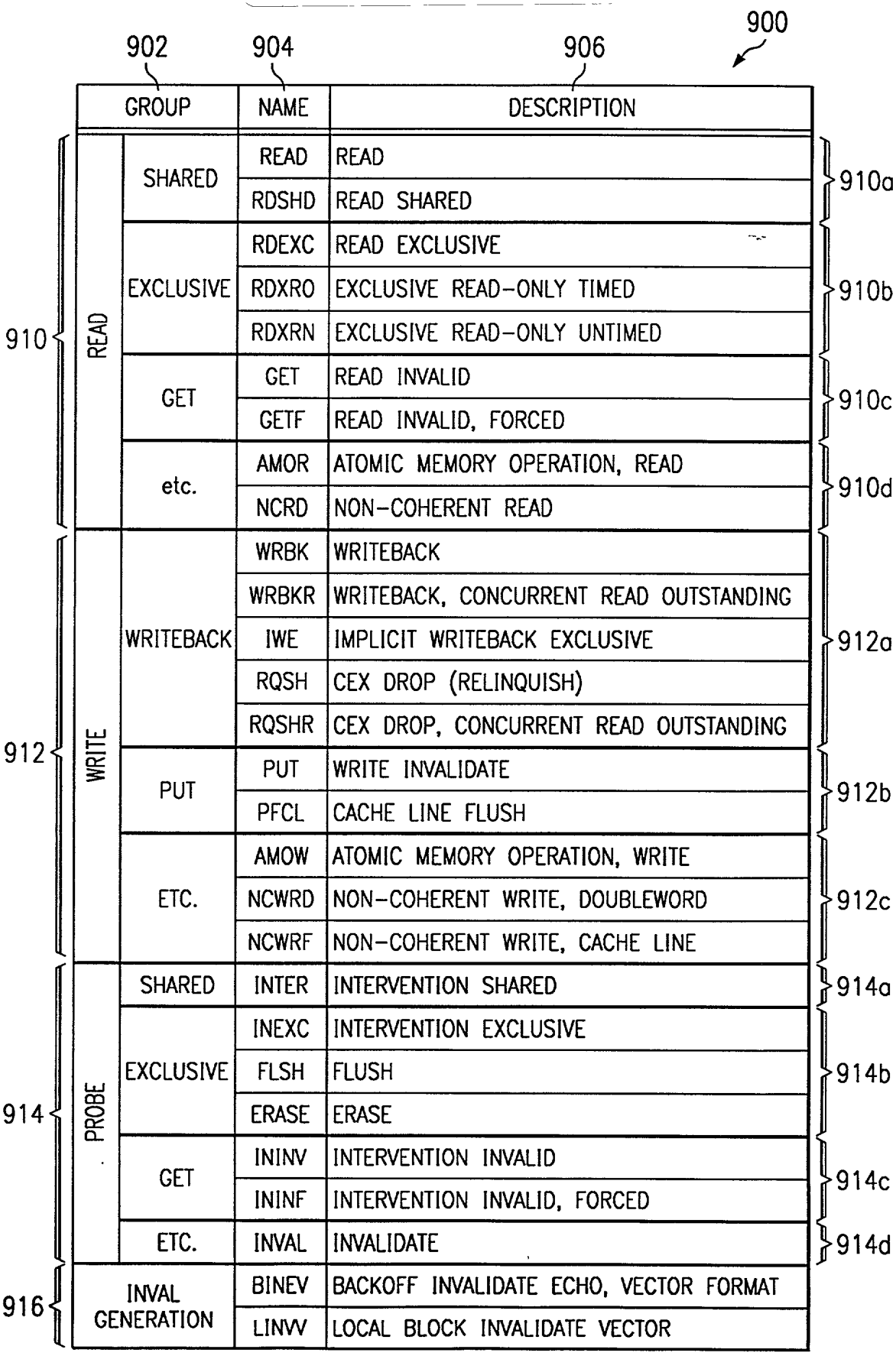

900
902
904
906
GROUP
NAME
DESCRIPTION
READ
SHARED
READ
READ
RDSHD
READ SHARED
EXCLUSIVE
RDEXC
READ EXCLUSIVE
RDXRO
EXCLUSIVE READ-ONLY TIMED
RDXRN
EXCLUSIVE READ-ONLY UNTIMED
GET
GET
READ INVALID
GETF
READ INVALID, FORCED
etc.
AMOR
ATOMIC MEMORY OPERATION, READ
NCRD
NON-COHERENT READ
WRITE
WRITEBACK
WRBK
WRITEBACK
WRBKR
WRITEBACK, CONCURRENT READ OUTSTANDING
IWE
IMPLICIT WRITEBACK EXCLUSIVE
RQSH
CEX DROP (RELINQUISH)
RQSHR
CEX DROP, CONCURRENT READ OUTSTANDING
PUT
PUT
WRITE INVALIDATE
PFCL
CACHE LINE FLUSH
ETC.
AMOW
ATOMIC MEMORY OPERATION, WRITE
NCWRD
NON-COHERENT WRITE, DOUBLEWORD
NCWRF
NON-COHERENT WRITE, CACHE LINE
PROBE
SHARED
INTER
INTERVENTION SHARED
EXCLUSIVE
INEXC
INTERVENTION EXCLUSIVE
FLSH
FLUSH
ERASE
ERASE
GET
ININV
INTERVENTION INVALID
ININF
INTERVENTION INVALID, FORCED
ETC.
INVAL
INVALIDATE
INVAL GENERATION
BINEV
BACKOFF INVALIDATE ECHO, VECTOR FORMAT
LINVV
LOCAL BLOCK INVALIDATE VECTOR
910
912
914
916
910a
910b
910c
910d
912a
912b
912c
914a
914b
914c
914d

FIG. 9

FIG. 10A

1000

1002 GROUP		1004 NAME	1006 DESCRIPTION	
1010 READ	SHARED	SRPLY	SHARED REPLY	1010a
		SRESP	SHARED RESPONSE	
		SACK	SHARED ACKNOWLEDGE	
		BINTR	BACKOFF INTERVENTION SHARED	
	EXCLUSIVE	ERPLY	EXCLUSIVE REPLY	1010b
		ESPEC	EXCLUSIVE SPECULATIVE REPLY	
		ERESP	EXCLUSIVE RESPONSE	
		EACK	EXCLUSIVE ACKNOWLEDGE	
		ERPYP	EXCLUSIVE REPLY, SEND PRGE	
		BIEXC	BACKOFF INTERVENTION EXCLUSIVE	
		BINVV	BACKOFF INVALIDATE, VECTOR FORMAT	
		BINVP	BACKOFF INVALIDATE, POINTER FORMAT	
	GET	IRPLY	INVALID REPLY	1010c
		ISPEC	INVALID SPECULATIVE REPLY	
		IRESP	INVALID RESPONSE	
		IACK	INVALID ACKNOWLEDGE	
		NACKG	NEGATIVE ACKNOWLEDGE TO GET	
		BIINV	BACKOFF INTERVENTION INVALID	
		BIINF	BACKOFF INTERVENTION INVALID FORCED	
	ETC.	AARP	AMO READ REPLY	1010d
		NCRP	NON-COHERENT READ REPLY	
		NACK	COHERENT READ NEGATIVE ACKNOWLEDGE	
1012 WRITE	WRITEBACK	WBACK	WRITEBACK ACKNOWLEDGE	1012a
		WBBACK	WRITEBACK BUSY ACKNOWLEDGE	
	PUT	WACK	WRITE INVALIDATE ACKNOWLEDGE	1012b
		WACKP	WRITE INVALIDATE ACK, SEND PRGE	
		WNACK	WRITE INVALIDATE NEGATIVE ACKNOWLEDGE	

TO FIG. 10B

Attorney Docket No. 062986.0201

1000

FIG. 10B

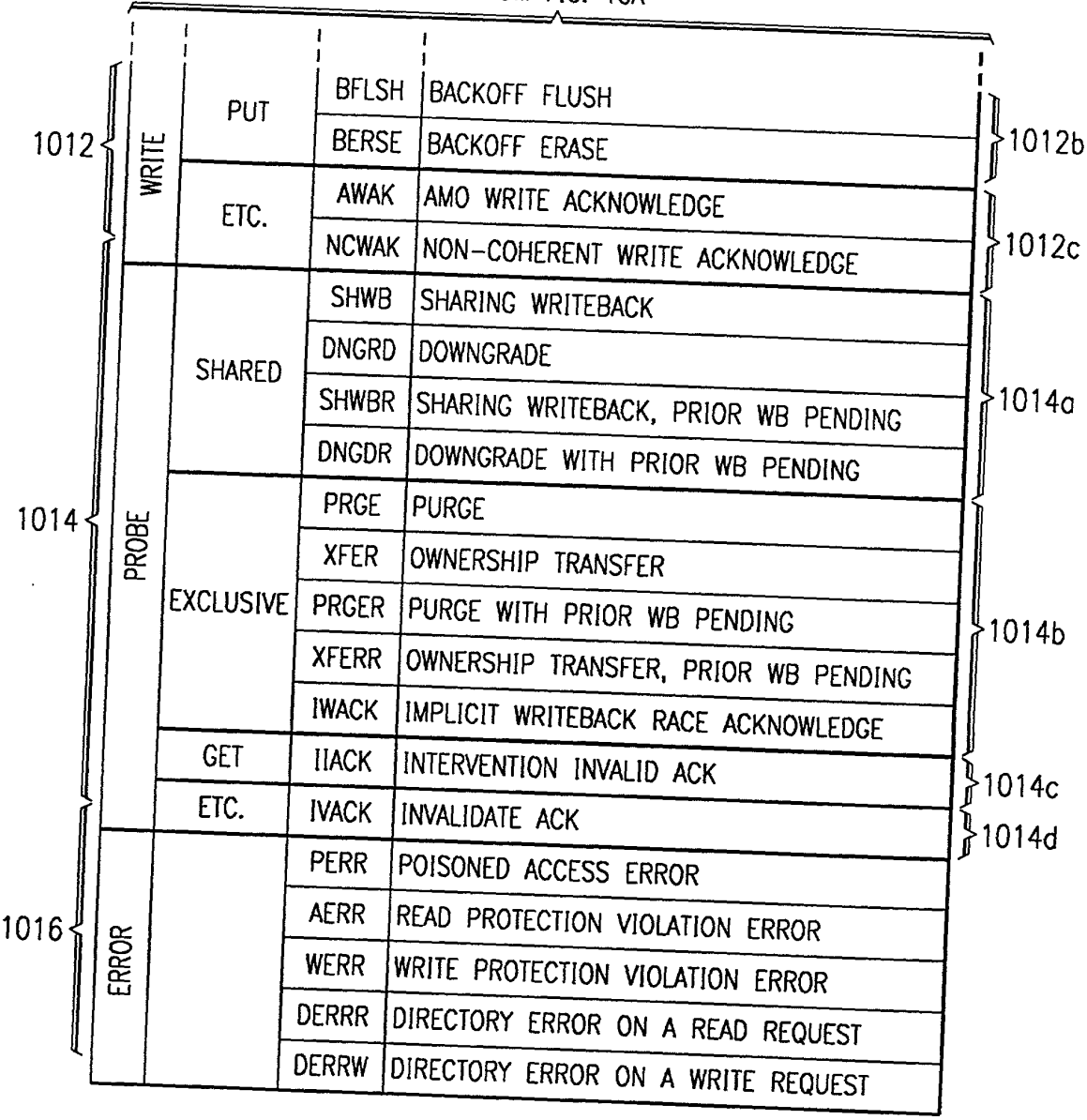

FROM FIG. 10A
1012
1014
1016
WRITE
PROBE
ERROR
PUT
ETC.
SHARED
EXCLUSIVE
GET
ETC.
BFLSH
BACKOFF FLUSH
BERSE
BACKOFF ERASE
AWAK
AMO WRITE ACKNOWLEDGE
NCWAK
NON-COHERENT WRITE ACKNOWLEDGE
SHWB
SHARING WRITEBACK
DNGRD
DOWNGRADE
SHWBR
SHARING WRITEBACK, PRIOR WB PENDING
DNGDR
DOWNGRADE WITH PRIOR WB PENDING
PRGE
PURGE
XFER
OWNERSHIP TRANSFER
PRGER
PURGE WITH PRIOR WB PENDING
XFERR
OWNERSHIP TRANSFER, PRIOR WB PENDING
IWACK
IMPLICIT WRITEBACK RACE ACKNOWLEDGE
IIACK
INTERVENTION INVALID ACK
IVACK
INVALIDATE ACK
PERR
POISONED ACCESS ERROR
AERR
READ PROTECTION VIOLATION ERROR
WERR
WRITE PROTECTION VIOLATION ERROR
DERRR
DIRECTORY ERROR ON A READ REQUEST
DERRW
DIRECTORY ERROR ON A WRITE REQUEST
1012b
1012c
1014a
1014b
1014c
1014d

FIG. 11

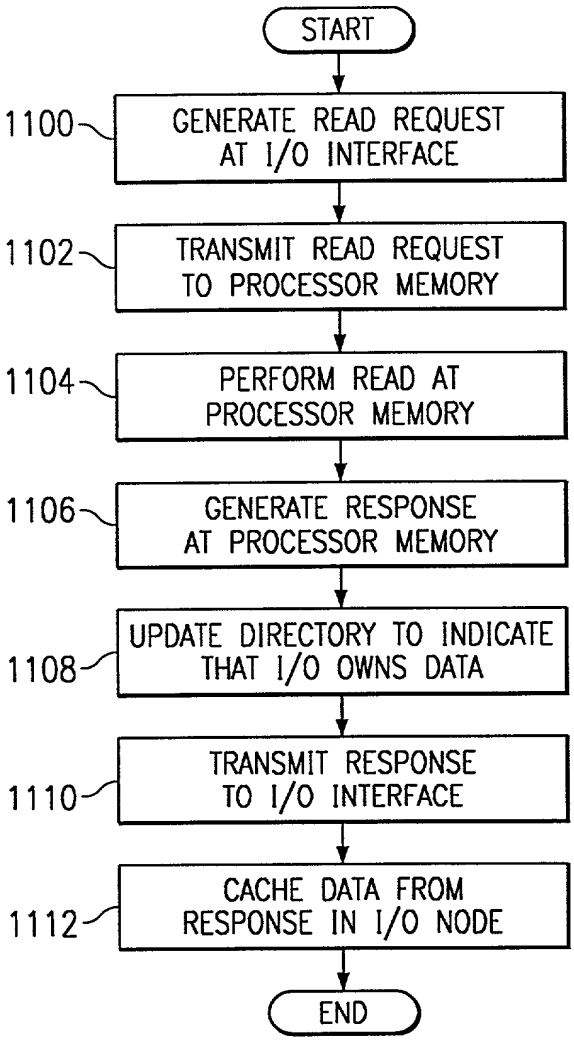

START
1100
GENERATE READ REQUEST AT I/O INTERFACE
1102
TRANSMIT READ REQUEST TO PROCESSOR MEMORY
1104
PERFORM READ AT PROCESSOR MEMORY
1106
GENERATE RESPONSE AT PROCESSOR MEMORY
1108
UPDATE DIRECTORY TO INDICATE THAT I/O OWNS DATA
1110
TRANSMIT RESPONSE TO I/O INTERFACE
1112
CACHE DATA FROM RESPONSE IN I/O NODE
END

FIG. 12

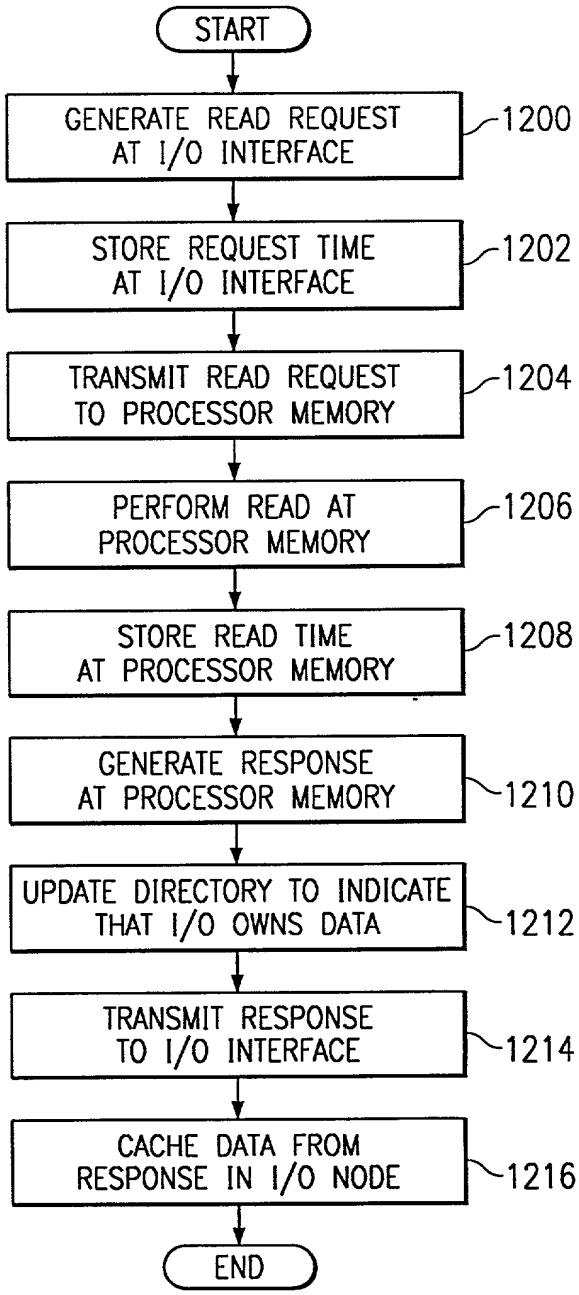

START
GENERATE READ REQUEST AT I/O INTERFACE
1200
STORE REQUEST TIME AT I/O INTERFACE
1202
TRANSMIT READ REQUEST TO PROCESSOR MEMORY
1204
PERFORM READ AT PROCESSOR MEMORY
1206
STORE READ TIME AT PROCESSOR MEMORY
1208
GENERATE RESPONSE AT PROCESSOR MEMORY
1210
UPDATE DIRECTORY TO INDICATE THAT I/O OWNS DATA
1212
TRANSMIT RESPONSE TO I/O INTERFACE
1214
CACHE DATA FROM RESPONSE IN I/O NODE
1216
END

FIG. 13

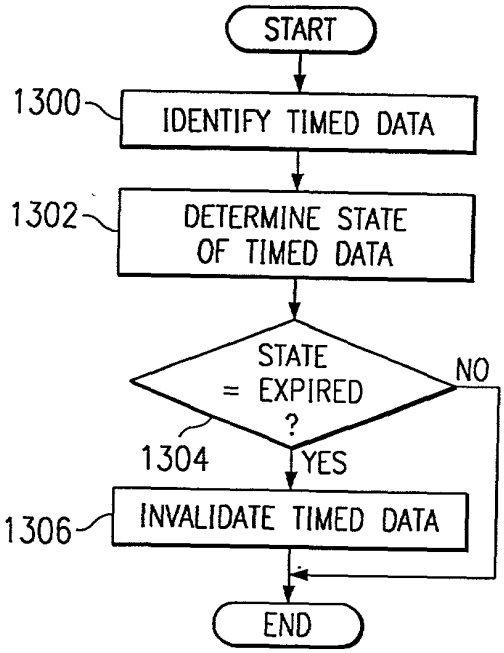


FIG. 14

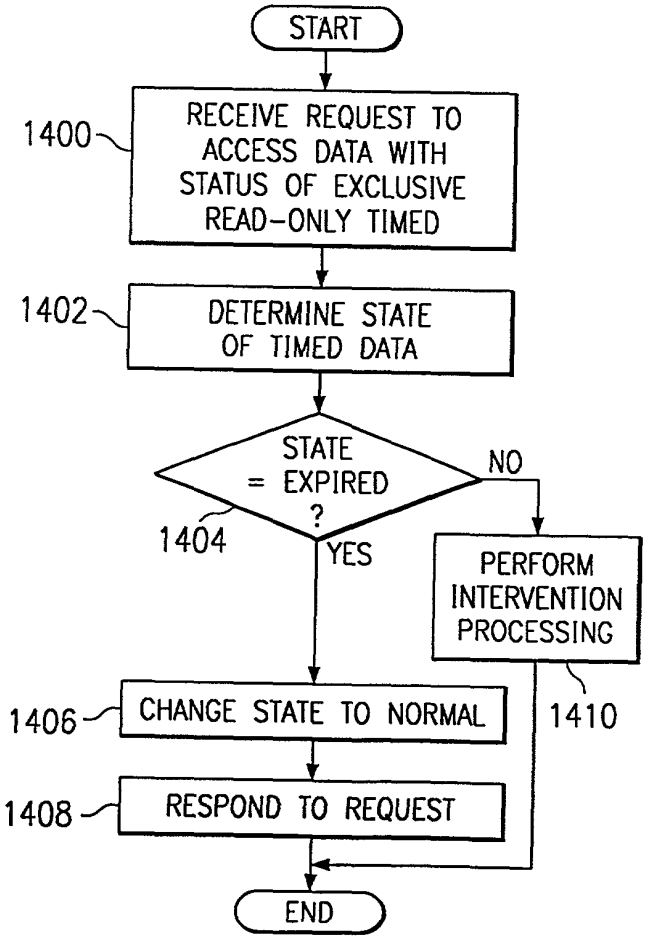
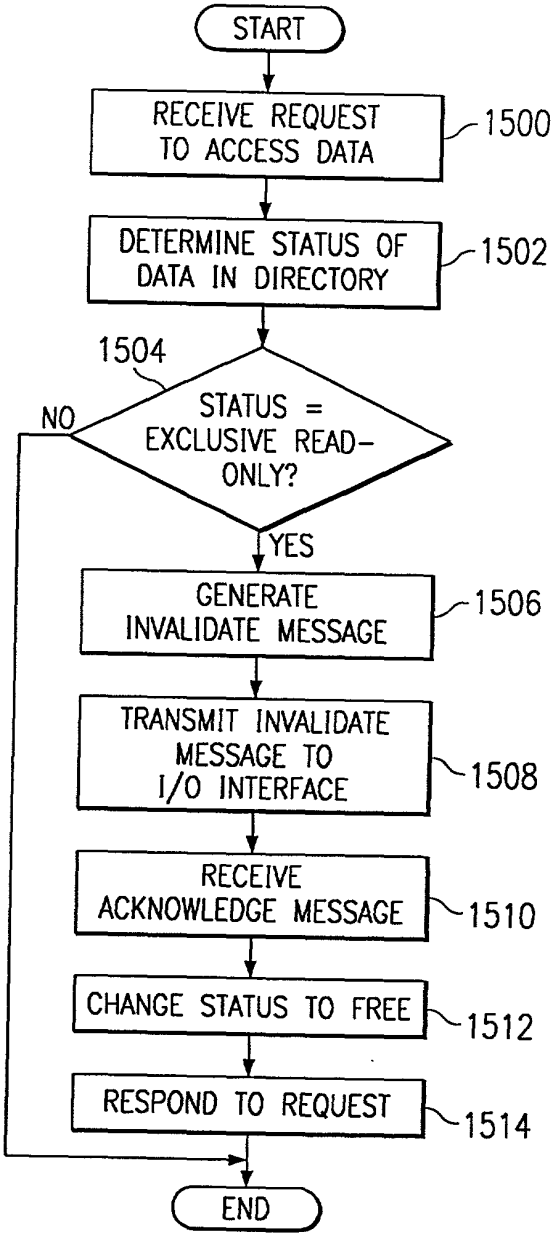



FIG. 15